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Mack Ott and John A. Tatom

Abstract: Requiring taxes to be paid in domestic money provides a legal tender basis for money demand and hence to the development of a financial system. In emerging markets, the level of taxation is a positive factor boosting financial development. At higher tax rates, however, taxation provides an incentive to reduce money demand and reduces the size of the financial sector. There is also evidence of re-switching in high-tax developed countries, where financial deepening increases with the tax rate. Such financial deepening represents a form of capital market repression, not unlike the growth-depressing effects of financial repression in many poor countries.

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Keywords: Taxation, financial development, money demand, money multiplier, emerging markets

The views expressed are those of the individual author and do not necessarily reflect official positions of Networks Financial Institute. Please address questions regarding content to John Tatom at john.tatom@isunetworks.org. Any errors or omissions are the responsibility of the author.

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1. INTRODUCTION

The role of institutions in the theory of economic development regained critical significance in the last decade, and this is nowhere more true than in efforts to explain the importance of monetary institutions in providing stable-valued money.¹ At the same time, attention has returned to the issue of the role of financial development as a factor affecting economic growth and development.² Taxes and inflation have long been recognized as providing incentives to avoid holding deposits in financial institutions and instead to employ barter, use domestic currency in black markets, or substitute foreign money as the principal unit of account, store of value and medium of exchange. Since both taxes and inflation are in the hands of the state, our hypothesis is that financial development and overall economic growth are dependent on the actions of the state.

The linkages between taxation and monetary development are not simple ones, however. As Lerner (1947) explained, the demand for domestic fiat money is rooted in the ability to use it to pay domestic taxes. In effect, taxation is the basis of a legal tender approach to money demand and hence to the development of a financial

¹ An important example in this renewal is North (1990). The literature on central bank independence, monetary constitutions, the role of transparency and credibility all reflect the growing importance of institutional development in promoting economic performance.

² Early proponents of the importance of financial development for economic growth are Shaw (1973) and McKinnon (1973). See Levine (1997) for a recent survey of the literature on the significance of this linkage.

system that produces and distributes financial assets based on domestic money.³ In this sense, taxation forms the institutional basis for money demand. As a result, in new states the level of taxation is a positive factor in boosting financial development. Beyond some level, however, taxation, like inflation, provides an incentive to reduce money demand and thereby reduces the size and contribution of the financial sector.⁴ Thus taxation takes on a special role in institutional development in new transition or emerging economies. This special role is the focus of this article.

This paper examines the connection between the use of domestic money—currency and deposits—and the effects of increased tax effort in enhancing such utilization in transition economies. This investigation is conducted in the broader context of effects of taxes in both emerging markets and developed countries to clarify the channels of influence. Broadly speaking, most transition and emerging economies are beset by numerous challenges to effective development and growth of the financial sector. These challenges include:

- mistrust of banks due to their history of frozen accounts, outright expropriation, lack of privacy,
- recurring bouts of high inflation reducing the credibility of the value of domestic currency deposits,

³ Selgin (1994) attributes to Knapp (1924) the idea that a requirement to use domestic fiat money is the basis for the demand for such money. Indeed, Knapp anticipated the arguments of Lerner by more than 50 years. We are grateful to Professor Selgin for calling our attention to Knapp's work. Selgin discounts the role of Knapp's notion of "public receivability," suggesting that it was secondary to a legal tender basis of fiat money.

⁴ To anticipate the argument below, states with relatively high tax rates could see another reversal in the effect of taxes on financial development. Taxation of capital income taxes risk-taking and at a sufficiently high level could provide an incentive to hold safe, low-yield bank deposits at the expense of risky assets. This could further the development of banking sector at the expense of entrepreneurial activity and growth.

- associated devaluations of domestic currency reducing money's purchasing power,
- ineffective tax administration, lowering the cost of tax evasion and increasing the proportion of underground economic activity,
- high tax rates on visible activities increasing the incentive to go underground,
- relatively large size of the underground economy, reducing the utility of recorded transactions,
- ineffective tax treatment of services,
- lack of contract enforcement, in particular ineffective seizures of liens on collateral, and
- lack of land or real property transferability.

This list, by no means exhaustive, suggests that money is less useful or more costly to use in transition and emerging economies than in mature market economies.⁵ Also implied is a relation to tax policy, and it is that tack that we will follow in this paper. In the next section, Abba Lerner's notion (1947) of money backed by implied tax liabilities is reviewed. From this discussion, the relation between money demand and taxation is inferred and differentiated from other effects of taxation. These relations are specified as a hypothesis in section 2. Section 3 presents the empirical tests and results. Brief concluding remarks are offered in section 4.

2. MONEY AS A CREATURE OF THE STATE

⁵ Beim and Calomiris (2000) discuss several other features that characterize financial repression (or result from it) including low real rates of interest, small shares of private sector credit and of bank lending, high reserve ratios and small market capitalization of financial firms relative to GDP.

For as long as fiat money has been used, the conundrum of its acceptability in exchange has been debated by philosophers, historians and economists. According to historians, when Marco Polo returned to Venice in the 14th century and reported that the Chinese used paper money, the proffered rationalization was alchemy; that is, somehow, the Chinese were able to convert paper to gold.⁶ Of course, this explanation is intrinsically valid: When paper money is backed by a commodity such as gold, the use of the relatively worthless surrogate is understood to be a claim check on the underlying asset.⁷ When money is not transformable into a commodity, but is simply declared to be legal tender as with contemporary currencies in the OECD economies, the apparent mystery remains.

A variety of explanations have been offered, most of which depend on some version of the greater fool theory—i.e., that the next seller is expected to accept it, so I will accept it. In comparison with commodity-backed money or bank money where either a real store of value or services is offered to compensate for the risk of devalue or dishonor, pure fiat money has no inherent rationale for its acceptability: *I accept it in exchange because I expect the next trading agent will be as naive as I am.*⁸

Abba Lerner offered a simple and sensible alternative to the greater fool theory for fiat money's acceptance. This argument was developed earlier and in more detail by Knapp (1924), but Lerner was apparently unfamiliar with it. Knapp was quite

⁶ See DeSoto (2000), p. 222.

⁷ This is the logic of the traditional goldsmith story used in money and banking courses, based on the origins of partial reserve banking in the Renaissance in northern Italy.

⁸ Kovenock and DeVries (2002) provide a model of demand for money based on a variant of the “greater-fool” theory.

explicit about the importance of the role of compulsory use of domestic money for tax payments in laying the basis for money demand. Indeed, he emphasized that a legal tender basis was not enough to motivate the demand for domestic money:

“In the autumn of 1895, in a course of lectures in Berlin, I put forward my views fully for the first time, laying down: that *the money of a State is not what is of generally compulsory general acceptance, but what is accepted at the public pay offices.*” p.vii (emphasis added)

Lerner’s explanation, like Knapp’s, for the acceptability of fiat money relies on the need for fiat money balances to pay tax liabilities: the government is not just willing, it *requires payment in fiat currency* for tax liabilities.⁹ Thus, in order to pay his taxes, each person must accumulate fiat money balances equal to his tax liability by the end of the tax period. This anticipated transaction—which requires a payment in fiat money—provides a convertibility guarantee for the fiat money during the period. Further, assuming that the tax liability is accepted and that the individual anticipates paying it punctually, he would have to accumulate money balances in advance of its due date. This implies that an effective tax program would create incentives to acquire and hold fiat money balances because, unlike the greater fool theory, it is certain that the tax collector will exchange—at a fixed and certain rate—the accumulated fiat money balances for the tax liability. These required money balances will be positively related to the size of the anticipated tax bill, which, in turn, is positively related to the individual’s tax rate. Consequently, the demand for money balances should be positively related to some measure of the government’s effort to

⁹ This is not to argue that the existence of tax payments requires the introduction of fiat money. To the contrary, the sovereign could dictate that commodity money or foreign money of any type be used. The requirement that tax payments be made in domestic fiat money, including bank deposits backed by domestic outside money, gives rise to a demand for domestic fiat money.

collect taxes. While the anticipated tax liability provides an incentive to hold fiat money balances, they do not need to be held in physical form as cash; a more efficient alternative would be bank deposit balances, either to facilitate other interim transactions or to earn interest. Thus, a broad measure of money (M2) which is convertible on reasonable notice into transferable funds should be the measure of the relevant asset whose demand is boosted by this requirement to pay taxes with fiat money.¹⁰

A systematic direct and positive relation is therefore expected to hold between tax effectiveness and both money demand and the size of the domestic financial sector. The higher the proportion of taxes that is collected, the higher will be the use of domestic money in the economy relative to foreign or private money and relative to GDP. This implies a positive relation between the average tax rate and (1) the use of domestic money in financing GDP expenditures—i.e., money demand, or the ratio of money to GDP, and (2) the size of the monetary sector, at least for “low-to-moderate” levels of taxation and development. It also follows that both money demand and the size of the monetary sector should be enhanced by greater tax effort. Note that this implies that the institution or existence of taxation requiring payment in domestic money not only generates a demand for domestic money, but the level of the tax rate incrementally affects the quantity of this money demand.

¹⁰ A referee of an earlier version of this paper suggested that mixing bank deposits and outside money muddles the issue of the demand for fiat money because bank deposits are not fiat money. We disagree and assume here that bank deposits backed by domestic fiat money are also fiat money. A basis for holding fiat money also bolsters the financial system according to the tax hypothesis.

Taxation has several effects beyond providing a basis for the demand for money, however. Typically, a large share of economic activity in emerging economies and especially in transition economies is underground. There are only two reasons for economic activities to be underground—either the activity is per se illegal or the entrepreneur is avoiding taxes on otherwise legal activity.¹¹ Thus, in the transition economies tax compliance is not high, taxes are actively evaded or avoided, and, as a result, measured GDP is understated. Furthermore, banks are not trusted—both because of the frequency with which deposits are frozen and because bank deposits and transactions using them provide data to the tax authorities about the income of the depositor. Thus, for tax-evaders, bank accounts do not provide a low-cost transactions medium. So, there is reason to expect that the relation between money demand and taxes could be attenuated by the relative size and growth of the underground economy—that is, the component of national income that is not included in GDP. The latter, in turn, is influenced by the size of the average tax rate.¹²

At a sufficiently high tax rate, individuals have an incentive to use barter, foreign money or domestic currency instead of domestic deposits for transactions and, in the latter cases, as liquid stores of value. The same effects arise in traditional tax avoidance behavior in the legal economy. Substitution of domestic currency for

¹¹ For simplicity, bureaucratic costs such as licensure and regulation can be thought of as part of tax load.

¹² Cagan (1958) and Feige (1985) emphasize the importance of taxation in affecting the demand for currency and the size of the underground economy. See Hill and Kabir (2000) for a recent review and evidence of tax effects on Canadian currency demand. Feige (1994) points out the importance of both the US underground economy and foreign underground economy for US currency demand. He argues that the latter is more substantial than the domestic underground economy and points up the importance of the issue for other major currencies.

bank deposits reduces the relative size of the financial sector as indicated in the money multiplier – the ratio of M2 to the monetary base. In addition, tax avoidance reduces the overall demand for money. A third channel of tax influence is that the average tax rate reduces wealth and disposable income and could further reduce money demand. Thus, a non-linear relation of tax rates to money demand and the size of the money multiplier is likely. Only at low tax rates and low real GDP per capita levels will the tax rate have a positive effect on money demand and the money multiplier.¹³

Finally there is a fourth channel of influence of taxation, though not relevant to emerging or transition economies. Taxation of capital market returns implies that the return to risk-taking is subject to taxation. A higher tax rate reduces the return on risky assets relative to that on safe assets such as bank deposits. At a sufficiently high tax rate, the demand for safe assets could actually be boosted by tax increases. This implies a second switch in high income countries in which money demand and/or the money multiplier is raised when taxes increase, just as in very low income, emerging or transition economies, but for very different reasons. If such a switch occurs, it casts serious doubt on potential growth effects of financial sector development. Such instances of a broader type of capital market repression are most likely only at high levels of taxation. In fact, there is evidence below of precisely this sort of re-switching. It is important to bear in mind that a positive relation

¹³ The tax rate and real GDP per capita are strongly positively correlated and can, with caution, be used interchangeably for low-income countries, presumably due to Wagner's Law. There are certainly other factors that can lead to low tax rates in relatively high income countries; indeed low tax rates often are cited as factor boosting the level of real GDP per capita (the US, Japan, Switzerland, Singapore, Hong Kong and Taiwan come to mind).

between tax rates and the demand for money at low tax/income levels is beneficial to financial development and presumably growth, while the same positive relationship in high-tax countries would represent a broader form of financial repression.¹⁴

3. THE EFFECTS OF TAXATION ON MONETARY DEEPENING AND THE MONEY MULTIPLIER--BASIC DATA CHARACTERISTICS¹⁵

The analysis above implies that both the demand for money and the money multiplier are affected by the average tax rate. Since the effect of the tax rate is hypothesized to vary with the state of financial market development, separate tests are conducted for emerging economies and for developed countries. The principal hypothesis is that at low levels of taxes (and real income per capita) increases in the average tax rate raises money demand and the money multiplier in emerging economies. Second, at sufficiently high tax rates, increases in tax rates lower both money demand and the money multiplier. The first hypothesis is based on the theory

¹⁴ There is no distinction here between different forms of taxation, particularly whether direct or indirect. It would be useful to investigate whether this difference matters, but data limitations preclude it here. Tax-based money demand is not dependent on the type of tax system, in principle. Kesselman (1993) has examined the effect of the tax mix on underground activity. Hill and Kabir (2000), following Smith (1994), note that similar evasion incentives exist for indirect taxes as exist for direct taxes. They find direct taxes have somewhat larger effects on currency demand in Canada than do value added taxes, however. Schneider (1994) shows that direct taxes in Canada have insignificantly larger positive effects on currency demand than do indirect taxes. The elasticities of real currency per capita with respect to direct taxes and indirect taxes are (standard errors in parentheses) 0.173 (0.056) and 0.117 (0.062), respectively, for the period 1956-91. Schneider also shows that the complexity of the tax system and the intensity of regulation have important effects on the currency ratio and underground economy. Indeed he argues that the effects of a major tax reform that lowered rates in 1989 was more than offset by a rise in the complexity of the tax system and increased burden of regulation. Schneider does not include inflation as a factor reducing real currency demand.

¹⁵ In the discussion and tests, M2 is used as the monetary asset. As monetary balances are accumulated to pay the tax liability at period's end, they could be held in time deposits as well as in demand deposits. Milton Friedman's aphorism that money is "the temporary abode of purchasing power" provides a familiar justification for preferring the broader measure of money. In addition, to assess financial sector development, a broader measure of bank liabilities is required than transaction deposits alone.

that money is a creature of the state, so that money demand is rooted in the imperative to pay taxes with domestic money. The second hypothesis is based on the fact that as taxes rise, tax evasion incentives progressively dominate, reducing money demand and the relative appeal of using domestic financial institutions. Since the effects in emerging economies can reverse sign as the tax rate rises, a quadratic tax effect is included in each specification. Moreover, the same quadratic tax rate effect specification is included in the developed country tests. This allows the possibility that there is re-switching of the tax rate effect at relatively high levels of the tax rate such as those found in some developed economies. Such a re-switching is based on “capital market repression” in which high taxes on entrepreneurial activity and risk-taking lower such activity relative to increased holdings of low-return, safe money balances.

The principal dependent variable in our tests is the velocity of M2 (V), which is the measured by the ratio of GDP to M2. This is the inverse of money demand, a common measure of financial depth. In addition, we also estimate the effect of tax effort on the monetary-base multiplier (K) as tax effort is expected to reduce the demand for currency relative to transaction deposits, and to boost the demand for interest earning deposits at banks at least in low-tax countries.¹⁶ These two effects

¹⁶ Beim and Calomiris (2000), following earlier studies, use the inverse of velocity as the indicator of liquidity, or financial deepening; a relatively low level of liquidity (high velocity) is an indicator of financial repression, as is a high level of bank reserves as a ratio to M2. This is consistent with the description above that emerging economies tend to have high velocities and low M2 multipliers. Roubini and Sala-i-Martin (1992, 1995) argue that financial repression boosts money demand. Such an effect is opposite to the expectation in the literature that financial repression raises the cost of financial intermediation and of holding money, in particular deposits, and hence raises velocity. It is also at odds with the evidence that velocity is highest in countries with a greater degree of financial repression. A simple example is a higher reserve requirement that directly and indirectly lowers the money multiplier. More important, a higher reserve requirement raises the cost of holding deposits

raise the M2 multiplier, but at higher tax rates, tax evasion effects may reverse the effects of a higher tax rate, so that a higher tax rate would reduce the money multiplier. As with money demand, an expected positive effect is expected to dominate at low tax rates.

The velocity of money and the M2 multiplier are both expected to depend upon other factors, most notably, real per capita income and the cost of holding money. The principal cost of holding money that has been identified in the literature is inflation.¹⁷ Inflation is a tax on real cash balances and hence reduces money demand or raises the velocity of money. A second key factor that influences money demand is real income per capita. For example, Selden (1956) and Friedman (1956) explain that if money is a luxury good, which earlier evidence had suggested, the growth in real income raises the demand for real cash balances more than proportionately, so that velocity would fall as real income per capita rises.¹⁸ In a growing economy where transaction deposits have a higher elasticity of demand than currency, and/or non-transaction deposits have a higher income elasticity of demand than transaction deposits, a rise in real income will boost the M2 multiplier. Finally, technological change and rising transfer efficiencies reduce the cost of financial services and

and money, thereby raising velocity. Other forms of repression also raise the cost of holding and using deposits, with similar effects.

¹⁷ See Friedman (1956), Cagan (1956) and Selden (1956).

¹⁸ Bordo and Jonung (1981) argue that velocity has a U-shaped trend over time, initially declining due to monetization of the economy and the rise of commercial banking, but rising later as a result of increasing financial sophistication and increasing economic stability. The same U-shaped pattern is expected here for transition and emerging economies based on the tax hypotheses. Bordo and Jonung indicate that the taxation of income from stocks and bonds could also affect velocity (p.113), but they do not indicate the source or direction of this effect. They focus on five developed economies (US, UK, Canada, Norway and Sweden), but their time period of 1870-1972 makes the relevant comparison here the experience in the emerging economies. Bordo and Jonung generally find that the real per capita income elasticity of money demand is one or less, contrary to the luxury hypothesis.

intermediation over time, lowering prices and providing incentives that increase the demand for money, especially bank deposits. To capture these effects, or control for them in the empirical specifications, we include the logarithm of real GDP per capita ($\ln X$), the rate of inflation ($Pdot$), a time trend (trend), along with the tax-GDP ratio (T) and the square of the tax-GDP ratio (T^2).

The empirical specifications employed are:

$$(1) \quad \begin{aligned} V &= a_0 + a_1 Pdot + a_2 T + a_3 T^2 + a_4 \ln X + a_5 \text{trend}, \\ K &= b_0 + b_1 Pdot + b_2 T + b_3 T^2 + b_4 \ln X + b_5 \text{trend} \end{aligned}$$

For transition and emerging economies, the expected coefficients on T are negative in the velocity equation ($a_2 < 0$) and positive in the money multiplier equation ($b_2 > 0$). As a result of the dominance of tax avoidance at higher levels of taxes, we expect the coefficient on the square of the tax rate (T^2), to have the opposite sign, the same sign as the other major cost of holding money, inflation ($a_3, a_1 > 0; b_3 < 0$).¹⁹ In developed economies, tax avoidance is again expected to be dominant so that the coefficient on the tax rate, T , in the velocity equation is expected to be the same as that on inflation and opposite to the signs in emerging economies ($a_2 > 0$). To allow for a possible non-linear effect, we include the same quadratic tax term in the developed country estimates. The income per capita effects are expected to be similar across countries with either negative or no effects on velocity (depending on whether money demand is a luxury or a normal good, respectively) and

¹⁹ The effect of inflation on the money multiplier is not well established. With competitive banking, inflation should raise the cost of transactions deposits relative to the cost of currency and the returns on non-transaction deposits, but these have offsetting effects on the multiplier.

corresponding positive or null effects on the money multiplier. The trend term is included to capture the increasing financial market sophistication of economies over time that is expected to boost money demand and the relative demand for private deposits over central bank money. Hence, the coefficients a_5 and b_5 are expected to be negative and positive, respectively.

The relative size of the underground economy is expected to reduce the quantity of domestic currency and deposits demanded, reduce real GDP relative to overall income, and to reduce the M2 multiplier, according to the analysis above. Since the size of the underground economy is not included in the estimates of equation (1), the coefficients in the estimated relationships could be biased. First, both inflation and the tax rate are expected to boost the size of the underground economy. Since this would lower the money multiplier and raise velocity, the omission of this variable would result in estimates of the coefficient on the tax rate and on inflation that are biased downward in the case of the money multiplier (b_1 and b_2). Since the effect of these measures is hypothesized to be positive for the money multiplier, at least at low levels of income, or especially, then, in emerging economies, these potential biases make it more likely to reject the hypotheses even if the hypotheses are true. Similarly for velocity, the coefficients are expected to be negative under the same conditions and the potential upward bias would make it more likely to reject a true hypothesis.

Second, an increase in the size of the underground economy lowers the level of measured real GDP. This can introduce a bias into the estimated effect of real GDP on either velocity or the money multiplier. Some of the decline in the money demand or the money multiplier arising from an increase in the size of the underground economy could be erroneously attributed to the effect of the related decline in real GDP, so the estimates of b_4 could be biased downward and the effect of income on velocity (a_4) is biased upward. We have no way of knowing the size of the effects of such biases, but at least in the case of tax effects, the central concern here, the direction of the bias works in favor of rejecting the hypothesis. Thus, failure to reject the hypotheses is stronger evidence than it would otherwise appear.

3.1. The data and countries

The hypotheses above were tested using data for 31 emerging economies and 17 developed countries for the period 1970-2000 (see Appendix A for the data sources, a list of the countries included and a list of missing data by country).²⁰ Countries were chosen on the basis of data availability and groupings were based on popular definitions. Thus, for example, Singapore and Spain, which were emerging economies at least in the early part of the sample period, are included with developed economies. Greece and Portugal, both European Union countries that are now part of the European Monetary Union, are included with the emerging economies countries, as is South Korea. Given the large number of observations in each group,

²⁰ Partial data for eight other important emerging or transition economies were available, but were not used in the regression analysis below because either the tax rate, velocity or real GDP per capita were missing for all years in the source data. These include Hong Kong, China, Russia, Croatia, Lebanon, Lithuania, Estonia, and Slovenia.

we do not expect the results to be affected by these choices. Seven transition economies are included (Poland, Hungary, the Czech Republic, Slovak Republic, Bulgaria, Latvia, and Romania), but only limited data is available for them. Indeed, data limitations are very great and prompt the use of cross-section, time-series regressions, though this would be a preferred method in any event.

Table 1 shows the basic characteristics of the measures for emerging and developed economies. As indicated earlier, emerging economies have much lower money multipliers and higher velocities than do developed countries. They also have lower average tax rates, much higher inflation rates and, of course, substantially lower real income per capita.²¹

4. EMPIRICAL TESTS AND STATISTICAL EVIDENCE OF TAXATION EFFECTS

Tables 2A and 2B provide correlation coefficients for the principal variables here. In emerging markets there is a significantly large negative correlation between the tax rate and velocity, indicating that higher tax rates are associated with larger money demand as hypothesized above.²² Note that for developed countries this correlation

²¹ This characterization may appear to suggest that there is an inverse correlation between inflation and the tax rate arising from substitution of the inflation tax for income and other taxes on economic activity. This would follow Roubini and Sala-i-Martin (1995) and might further suggest that higher tax effort could reduce the inflation tax and inflation rate, with the latter effect boosting money demand somewhat. There is no correlation between inflation and the tax rate in emerging economies, however, according to Table 2A below. More importantly, in an efficient tax system both the tax rate and the inflation rate would move up together as the share of government expenditure increases. The tax rate and inflation rate would be positively correlated. The characterization above can result from a relatively higher estimated marginal cost of revenue from direct taxation in emerging economies than in developed economies, given inflation. In any event, in the tests below we control for inflation in estimating the effects of the tax rate so that such an indirect effect, however unlikely, would not affect the interpretation of tax rate effects.

²² The number of observations for each pair of variables shown in the correlation matrix differs and has been taken into account in assessing the t-statistic.

is opposite in sign and almost equal in magnitude. In developed countries, higher taxes, like inflation, reduce the demand for money. The tax rate has no significant correlation with the money multiplier in either emerging markets or developed countries. In both emerging markets and developed countries inflation and money demand (velocity) are significantly negatively (positively) correlated. Inflation also is negatively correlated with the money multiplier in developed countries, but not significantly so in emerging economies.

Real per capita income is significantly and positively correlated with both money demand and with the money multiplier in both emerging and developed economies. In general, these results are strongly supportive of the hypotheses above with two exceptions.²³ These exceptions are that the money multiplier is not significantly related to taxes in either set of countries, and it is not related to inflation in emerging economies. These results also summarize well the more substantive results in the regression analysis below where, except for support for the quadratic tax effects found there and the absence of an income effect on velocity in emerging markets, the findings are identical.

4.1. Regression Results

The regression estimates for velocity are shown in Table 3 for both developed and emerging economies. These estimates are reported with and without the inclusion of dummy variables that account for country specific differences--i.e. differences that are not accounted for by the included independent regressors--in velocity and (in the

²³ Note that the average tax rate and real GDP per capita are significantly positively correlated, especially in emerging economies, as described above.

next table) money multiplier. First, velocity regression estimates are presented that include all variables (except country dummies) followed by a preferred model that excludes insignificant variables. Then estimates including country effect dummies are given.

While the country effect dummies allow for country-specific differences in velocity or the multiplier that arise for reasons other than the other included measures, the included regression variables themselves are also country specific. That is, some countries have relatively high or low inflation, tax rates or per capita income. Thus the inclusion of country effects can bias the estimates and tests of the latter effects. Nevertheless, the country-effect equations do provide evidence on the robustness of these effects.

In the absence of country effects, real GDP per capita in both emerging economies and in developed economies is not statistically significant and so the preferred equation shown in the second column on the right omits the GDP variable. The absence of an effect of real GDP per capita on velocity indicates that money is normal, or its income elasticity of demand is unity so that increases in income have equal proportionate effects on money demand.²⁴ The significant negative trend term for both sets of countries supports the view that there is a common rate of change in financial technology that lowers costs of holding and using financial services and boosts money demand.

²⁴ Bordo and Jonung (1981) find this to be the case for the US over the period 1880-1972, and also for Norway and the UK when their institutional variables are included. Only Canada and Sweden show significant and positive effects of real per capita income on velocity in the latter case, indicating income elasticities of money demand that are less than one.

In emerging economies, a rise in the tax rate reduces velocity (raises money demand), as the money demand hypothesis predicts. However the negative coefficient on the square of the tax rate indicates that at a sufficiently high level of the tax rate, this effect reverses sign. This tax rate, called the switching tax rate, is shown in the table to be 36.4%.²⁵ At lower tax rates, a rise in the tax rate raises money demand; at higher tax rates, a rise in the tax rate lowers money demand. Inflation also has a significant negative effect on money demand in emerging markets, though this effect is smaller than in the developed economies.

For developed countries, the tax variables have the opposite signs to those for emerging markets. Thus there is again a switching-tax rate, but for developed countries a rise in taxes initially lowers money demand until a sufficiently high tax rate is reached. Beyond this level, a higher tax rate boosts money demand, just as occurs at relatively low tax rates in emerging economies. This tax rate at which switching occurs is estimated to be 42.3%. Apparently at a high enough tax rate, the demand for money rises with the tax rate, as safe, less-risky assets become more attractive than risky assets. High tax rates discriminate against risky assets and lead to repression of capital markets. While the adjusted-R² indicate that the variables included do not explain much of the variation observed in velocity across countries, the explanatory power is not unusually low for cross-section data.

²⁵ The switching tax rate is found by setting the derivative of velocity with respect to the tax rate equal to zero and solving for the tax rate. In terms of equation 1, the switching tax rate is $(-a_2 / 2a_3)$.

The inclusion of country-effect dummy variables does not affect the sign or significance of the tax rate variable in either set of countries.²⁶ Thus, the role of taxes in boosting money demand in emerging economies and lowering it in developed countries is robust to controlling for country effects. However, with country effects included, the switching of the tax rate effect at higher rates in emerging economies is not statistically significant. Capital market repression in developed countries remains statistically significant when country effects are included. With country effects, inflation is not significant in either data set. It is likely that the effect of inflation on velocity is being captured by the country dummy in the high-inflation countries. The effect of real GDP per capita emerges as significant and negative when country effects are included, suggesting that money is a luxury, with demand increasing more than proportionately with income increases, and hence lowering velocity. This differs from the insignificant effects of real per capita income when country effects are omitted (implying a unitary real per capita income elasticity of money demand). While the fit of the estimates improves sharply when country effects are included, their inclusion biases the hypothesis tests so that we consider the results without country effects to be more appropriate for testing the hypotheses and for characterizing the effects.

These regression estimates for velocity comport closely with the simple correlation evidence. The principal differences are that the regression results allow for significant switching and re-switching in the effects of tax rates on money demand or financial deepening and also include time trends. At low levels of taxation, tax hikes

²⁶ The country effect dummy variables for the reported velocity estimates and for the money multiplier estimates are presented in Appendix B.

boost financial development as taxes play their role of providing an institutional foundation to the demand for money, as explained by Lerner. Once taxes rise above about 37%, however, tax avoidance takes a toll on financial deepening. At relatively high tax levels in developed countries (above about 42%), higher tax rates actually lead to a re-switching, boosting the financial sector, but apparently at the expense of entrepreneurial activity. This effect is not large, however, according the simulated effects shown in Figure 1 below.

A second, and more minor difference is that real income per capita is not related to velocity in the regression results (excluding country effects), unlike the significant negative correlations. Presumably, the significant negative trend terms, which are correlated with real GDP per capita, account for the negative correlation coefficients in Table 2.

It is difficult to judge the economic significance of the tax rate effects on velocity from the equation estimates alone. Figure 1 shows the effects of the tax rate on velocity in both emerging and developed economies.²⁷ The effects are based on the estimates excluding country effects in Table 3. In each case the variation of velocity around its sample mean due to changes in the tax rate are plotted.

The tax rate varies up to about 58 percent, about the maximum level in emerging or developed economies. The asymmetric behavior of velocity in emerging and developing economies is evident. Money demand increases as the tax rate rises in

²⁷ Particularly striking is the U-shaped relation of velocity to the tax rate in emerging economies, reflecting the linear and quadratic tax effect; this relation was predicted by Bordo and Jonung (see note 16 above) as a result of financial development which, at least in part, the tax effort represents.

emerging economies, while it falls in developed countries. At tax rates exceeding the switching-tax-rate, the patterns reverse, and money demand falls in emerging economies and rises in developed economies.

Velocity is quite sensitive to movements in the tax rate in both sets of countries, especially at relatively low tax rates. For comparison purposes the effects of variations in velocity due to changes in the inflation rate in developed countries is shown. Note that the slopes of the curves (for tax effects and inflation effects) in developed countries are similar for tax and inflation rates in the range from 20 to 30 percent, and actually higher at lower tax rates. While velocity in developed countries falls (money demand rises) after the switching- tax rate of about 42.3%, the decline is not large compared with the absolute value of either the slope at lower tax rates or to the sensitivity (slope) with respect to inflation. This negative slope steepens as the tax rate rises above the maximum tax rate used in the figure, but such tax rates are also beyond the sample range.

The regression estimates for the money multiplier estimates are shown in Table 4. Excluding country effect dummies, the developed economies' regression estimate has many more coefficients that are not statistically significant than is the corresponding case for velocity in Table 3--only the time trend coefficient is significant at standard levels.²⁸ In contrast, the regression estimate for emerging economies has

²⁸ Multipliers have some noticeable outliers among developed countries. The UK and Spain have multipliers that range from 15 to 40 since 1986, substantially higher than elsewhere. These differences reflect much lower reserve requirements instead of differences in tax rates or inflation. Among emerging markets, two countries have multipliers above 10: South Africa and Portugal, after 1994.

coefficients that, except for inflation, are all highly significant with the anticipated signs. In the emerging market economies, a higher tax rate raises the M2 multiplier when tax rates are relatively low, but this sign reverses as the tax rate increases due to the effect of the quadratic tax-rate term. This is consistent with the results for money demand as well, though the switching- tax rate at which the sign reverses is lower, 23.7%, closer to the sample mean for emerging market economies (explaining the lack of correlation between tax rate and multiplier shown in Table 2A). Also, the desired mix of currency, non-transactions deposits and transaction deposits is not affected by inflation in low-income countries since inflation has no significant effect on the M2 multiplier. but a higher real income per capita raises the multiplier, reflecting higher income elasticity of demand for non-transaction deposits relative to transaction deposits. Finally, there is a significant positive trend in the multiplier for both emerging and developed economies. These results are consistent with the velocity results and the hypothesis that technical change lowers the costs of financial services and holding money, boosting the size of the financial sector relative to the monetary base and boosting overall money demand.

For developed countries, only the trend term is statistically significant in the absence of country effects. In particular, there is no statistically significant effect of the tax rate on the M2 multiplier. Note that this does not mean that the tax rate does not affect financial sector development. It only means that there is no differential effect boosting M2 relative to the monetary base as there is in low-income countries. The pair of tax rate variable coefficients is significantly different from zero only at a low

confidence level (about 85%) and the signs, magnitude and switching- tax rate are quite similar to those in emerging economies. At conventional significance levels we cannot attach much importance to these similarities, but they are striking.²⁹

When country effects are included, the results for emerging economies are qualitatively the same, except the switching- tax rate rises by about one-fourth. In particular, the tax rate has a significant positive effect on the money multiplier for tax rates up to about 30 percent, then the effect turns negative, with higher taxes reducing the money multiplier. For developed countries, the inclusion of country effects has a major impact on the significance of the other estimated coefficients. The tax variables become statistically significant and have the same sign, magnitude and switching- tax rate as in the emerging economies' estimate. In addition the effect of inflation on the money multiplier is negative and statistically significant in the developed country case, mirroring the velocity result and indicating that inflation reduces the demand for M2 relative to the monetary base in these countries.

The principal difference between conclusions from the correlation coefficients and the regressions concerns the relationship between the multiplier and the tax rate. The correlation coefficient between the tax rate and the money multiplier is insignificant, but in the regression estimates, there is a significant positive effect of the tax rate on the multiplier that switches to a negative effect at high tax rates, according to the regression estimates, especially for emerging economies.

²⁹ In another, unreported, estimate we found only one other variable (or set of variables) to be significant: This equation included the constant, trend and the tax rate; in this estimate, the tax rate term had a coefficient of -6.6599 ($t = -3.26$).

5. CONCLUSIONS

To our knowledge, Lerner's insight of the beneficial tax effects enhancing money demand and financial sector development has not been previously examined or tested. The orthodox view that individuals would react to taxes negatively in forming decisions about the use of domestic financial sector transaction deposits and holding non-transaction assets just as they rationally react to the other major cost of M2—inflation—seems so reasonable as not to have been questioned. Indeed, in developed economies and at high tax rates in emerging economies this expectation is supported by the data. However, the research here is motivated by an interest in financial development in transition and emerging economies, and for these purposes Abba Lerner's original insight on the role of taxation in creating a demand for fiat money, the ultimate legal tender rationale, serves as our focus.³⁰ We find evidence supporting this hypothesis in the experience of emerging economies.

Nonetheless, there is also a critical caveat offered up by the evidence here. As tax rates rise these beneficial effects for financial development disappear and reverse. Tax avoidance effects dominate at high tax rates as taxes reduce incentives to hold and use bank deposits relative to currency, foreign money or barter. In fact, we find some evidence of re-switching in very high-tax-developed countries, where financial deepening increases with the tax rate because of the relatively low return from risky

³⁰ As noted above, this idea was developed earlier by Knapp (1924). We conjecture that Knapp's notion—and probably Lerner's, too—is that rarest of birds, a true innovation. We have searched the legal tender literature, surveys of the taxation literature, and reviewed what has been published in the *Encyclopedia of the Social Sciences* on money and on taxation. Nothing there suggests that this idea has been proposed by anyone. Their idea simply is not raised. More recently, Martin Shubik (1987) article on fiat money in the *New Palgrave Dictionary of Economics* does not mention this possibility while reviewing all of the standard elements on the history of fiat and token money.

entrepreneurial activities. Such financial deepening due to artificially raising the attractiveness of safe bank deposits represents a form of capital market repression, not unlike the growth- depressing effects of financial repression in many poor countries.

Governments can promote financial development through efforts to achieve price stability and through a moderate degree of taxation. Both policies promote an increased demand for domestic money, raising the size of the financial sector as a share of GDP. Efforts to support tax effort through efficient enforcement and collection efforts that maximize taxpayer compliance are perhaps more important than the size of the tax rate itself, though the evidence here is only suggestive of this conclusion. There is certainly a trade-off suggested that could keep the tax rate below the switching- level by more broad-based compliance with the tax law.

We have not addressed the issue of optimal taxation here. If tax rates affect financial deepening, the size of the banking sector and the growth rate, then these effects must be taken into account in assessing the optimal level and structure of taxation. In particular, if tax rate increases boost growth indirectly through an effect on financial deepening then this indirect effect must be compared to the direct effects of taxes on growth that arise through incentives for capital formation.

Appendix A

Annual data for the tests 1970-2000 were obtained from the International Monetary Fund's *International Financial Statistics*, using the year 2000 CD-ROM, the annual statistics volume for 2000, and recent monthly issues.

Variable and Composition	IFS line #
$M2 = M1 + MQ$	34, 35
$V = M2/GDP,$	99B (GDP)
$K = M2/\text{Monetary Base}$	14 (Base)
$T = \text{Tax Effort} = \text{Tax Receipts}/GDP$ receipts)	80, 82 (Tax
$PDOT = CPI/CPI(-1)$	64

The real GDP per capita measures are based on World Bank data for real GDP in 1996 international prices in US dollars and population. These data are available through 1999 in most countries so regressions or statistics containing these measures implicitly end in 1999.

Table A1 indicates the data availability for each measure. There are large numbers of missing data. For example, among emerging economies there is a maximum of 961 possible observations (31 countries over 31 years), but the sample of common variables used for the velocity estimates is only 605 observations and for the money multiplier there are 633 observations. Despite having slightly more than one-half as many developed countries, there are proportionately more observations for velocity (458) and money multiplier (462) estimates.

Table A1					
Missing Data in 1970-2000 Sample					
	Money Multiplier	Tax Rate	Inflation	Velocity	Real GDP per capita*
Developed (17)					
AUSTRALIA	2000	98-00			
AUSTRIA	98-00	99-00		98-00	
BELGIUM	98-00	99-00		98-00	
CANADA		98-00			
DENMARK	2000	2000		2000	
FRANCE	98-00	98-00		98-00	
GERMANY	99-00	99-00		99-00	93-00
ITALY	99-00	99-00		70-73;99-00	
JAPAN		94-00			
NETHERLANDS	98-00	70-85; 99-00		98-00	
NORWAY		98-00			
SINGAPORE					
SPAIN	99-00	99-00		99-00	
SWEDEN					
SWITZERLAND					
UNITED KINGDOM		2000			
UNITED STATES		91-93			
Emerging Markets (31)					
ARGENTINA	70-83	70-83;2000		70-82	70-82
BRAZIL		70-87;95-96;98-00	70-80	70-80	70-88
BULGARIA	70-90	70-87;2000	70-85	70-90;2000	70-79;98-00
CHILE		2000			
COLOMBIA	86;89	70-93		86;89	70
CZECH REPUBLIC	70-93	70-93	70-94	70-93	98-00
ECUADOR					
EGYPT		(70-74;80,99,00)		2000	
GREECE	99-00	97-00		99-00	
HUNGARY	70-81	70-80	70-73	70-81	98-00
INDIA		2000		2000	
INDONESIA		2000			
JORDAN		2000			
LATVIA	70-92	70-94	70-91	70-92	98-00
MALAYSIA		2000			
MEXICO		70-79			
MOROCCO		2000		2000	
NIGERIA		96-00		95-00	
PAKISTAN					
PERU	70-83	70-83;00		70-83	
PHILIPPINES					
POLAND	70-79	70-83;89-93;00	70	70-79	
PORTUGAL	99-00	99-00		ALL	
ROMANIA	70-72	70-79	70-90	70-79	
SLOVAK REPUBLIC	70-92	70-95;00	70-93	70-92	70-83;98-00
SOUTH AFRICA	91			91	
SOUTH KOREA		2000			
THAILAND					98-00
TUNISIA	70,71,00	70-71;00	70-83		
TURKEY		70-86;00		70-86	98-00
VENEZUELA		99-00			

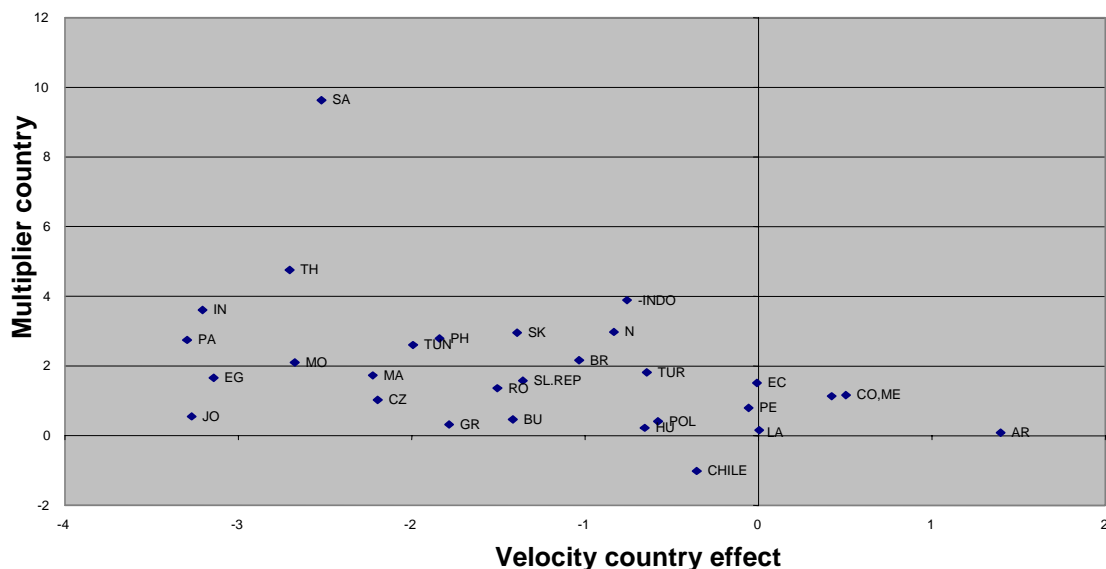
* 2000 missing for all countries

Appendix B

Country Effects

This appendix presents data on the country effects (dummy variables for each country) for velocity and the money multiplier in both developed and emerging economies. Chart B1 shows the velocity and multiplier dummy variables for emerging countries. The labels for the points are abbreviations for country names and are provided in Table B1 (as are the point values). Generally the velocity deviations are negative (positive for money demand) and positive for the money multiplier. Note that mostly Latin American countries make up the exceptions with relatively large velocity and low money demand. The multiplier for South Africa stands out as unusually large, probably indicating a relatively low reserve ratio for the banking system. The multiplier for South Africa stands out as unusually large, probably indicating a relatively low reserve ratio for the banking system. The dummy for Venezuela is not included in the estimates to avoid an identity.

Chart B1
Emerging country effects for money demand and the multiplier are usually positive



For developed countries, the pattern of country dummies is more balanced. Belgium and Italy have unusually large velocity (low money demand), presumably due to relatively high inflation over the period. The correlation between the country effect for velocity and inflation is 0.29. At the other extreme, Singapore stands out as a country with unusually low velocity (high money demand). The UK and Spain have unusually high money multipliers, presumably due to relatively low ratios of bank reserves relative to bank deposits. The dummy variable for the US is omitted to avoid an identity.

Chart B2
Velocity and Multiplier effects in developed countries

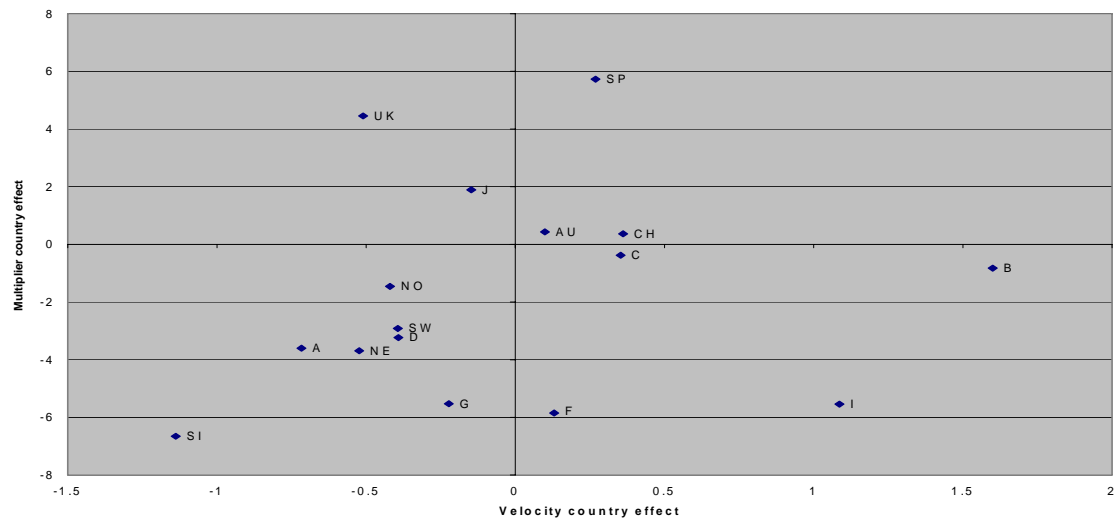


Table B1 below provides the abbreviations used in the preceding charts, the data points and whether the effects are statistically significant (bold).

TableB1

Developed Country		Dummy for velocity		Multiplier	Emerging Country		Dummy for velocity		Multiplier	Emerging Country		Dummy for velocity		Multiplier
Australia	AU	0.099		0.431	Argentina	AR	1.397		0.085	Nigeria	N	-0.834		2.983
Austria	A	-0.717		-3.604	Brazil	BR	-1.034		2.172	Pakistan	PA	-3.295		2.748
Belgium	B	1.6		-0.828	Bugaria	BU	-1.417		0.471	Peru	PE	-0.056		0.802
Canada	C	0.353		-0.377	Chile	CHILE	-0.355		-1.014	Philippines	PH	-1.84		2.791
Denmark	D	-0.394		-2.92	Colombia	CO	0.422		1.137	Poland	POL	-0.58		0.415
France	F	0.13		-5.85	Czech Rep	CZ	-2.195		1.028	Romania	RO	-1.506		1.369
Germany	G	-0.223		-5.528	Ecuador	EC	-0.008		1.516	Slovak Rep.	SL.REP	-1.358		1.586
Italy	I	1.086		-5.544	Egypt	EG	-3.142		1.662	S. Africa	SA	-2.52		9.633
Japan	J	-0.148		1.893	Greece	GR	-1.784		0.326	S. Korea	SK	-1.392		2.958
Netherlands	NE	-0.523		-3.689	Hungary	HU	-0.657		0.225	Thailand	TH	-2.704		4.756
Norway	NO	-0.42		-1.459	India	IN	-3.206		3.609	Tunisia	TUN	-1.992		2.605
Singapore	SI	-1.138		-6.66	Indonesia	INDO	-0.757		3.893	Turkey	TUR	-0.644		1.815
Spain	SP	0.269		5.73	Jordan	J	-3.27		0.557	Venezuela	V	0		0
Sweden	SW	-0.392		-3.232	Latvia	LA	0.005		0.154					
Switzerland	CH	0.361		0.365	Malaysia	MA	-2.224		1.731					
UK	UK	-0.51		4.455	Mexico	ME	0.505		1.168					
US		0		0	Morocco	MO	-2.674		2.106					

Bold figures are statistically different from zero (95%)

References

- Barro, Robert, "Inflation and Economic Growth," *Bank of England Quarterly Bulletin*, May 1995, pp. 166-75.
- , "Inflation and Growth," *Federal Reserve Bank of St. Louis Review*, Vol. 48, no.3, May/June 1996, pp.153-69.
- Beim, David O. and Charles W. Calomiris, *Emerging Financial Markets*, (Boston: McGraw-Hill Irwin, 2001).
- Bordo, Michael David and Lars Jonung, "The Long Run Behavior of the Income Velocity of Money in Five Advanced Countries, 1870-1975: An Institutional Approach," *Economic Inquiry* 19, No. 1, (January 1981), pp. 96-116.
- Cagan, Phillip, "The Monetary Dynamics of Hyperinflation," in Milton Friedman, (Ed.) *Studies in The Quantity Theory of Money*, (Chicago: University of Chicago Press, 1956), pp. 25-117.
- , "The Demand for Currency Relative to Total Money Supply," *Journal of Political Economy* 66, 1958, pp. 303-29.
- DeSoto, Hernando, *The Mystery of Capital*, (New York: Basic Books, 2000).
- Feige, Edgar L., *The Underground Economy*, (Cambridge: Cambridge University Press, 1989).
- , "The Underground Economy and the Currency Enigma," in Werner W. Pommerehne (ed.), *Public Finance and Irregular Activities*, supplement to *Public Finance* 49, 1994, pp. 119-36.
- Friedman, Milton, "The Quantity Theory of Money—A Restatement," in Friedman, Ed. *Studies in the Quantity Theory of Money*, (Chicago: University of Chicago Press, 1956).
- Hill, Roderick and Muhammed Kabir, "Currency Demand and the Growth Rate of the Underground Economy in Canada, 1991-1995," *Applied Economics* 32, 2000, pp. 183-92.
- Kesselman, J. R. "Evasion Effects of Changing the Tax Mix," *The Economic Record* 69, 1993, pp. 131-48.

- Knapp, Georg Friedrich. *The State Theory of Money*, London: Macmillan, 1924. An English translation based on the fourth edition of the original 1905 German work.
- Kovenock, Dan and Casper G. DeVries, "Fiat Exchange in Finite Economies," *Economic Inquiry* 40, No. 2 (April 2002), pp. 147-57.
- Lerner, Abba, "Money as a Creature of the State," *American Economic Review*, 37, No. 2, Papers and Proceedings, (May, 1947), pp. 312-317.
- Levine, Ross, Financial Development and Economic Growth, *Journal of Economic Literature* 35, 1997, pp. 688-726.
- McKinnon, Roland, *Money and Capital in Economic Development*, (Washington D. C.: Brookings Institution, 1973).
- North, Douglas, *Institutions, Institutional Change, and Economic Performance*, (Cambridge: Cambridge University Press, 1990).
- Roubini, Nouriel and Xavier Sala-I-Martin, "Financial Repression and Economic Growth," *Journal of Development Economics* 39, No. 1, July 1992, pp. 5-30.
- _____, "A Growth Model of Inflation, Tax Evasion and Financial Repression," *Journal of Monetary Economics* 35, No. 2, April 1995, pp. 275-301.
- Selden, Richard T., "Monetary Velocity in the United States," in Milton Friedman, (Ed.) *Studies in The Quantity Theory of Money*, (Chicago: University of Chicago Press, 1956), pp. 179-257.
- Selgin, George. "On Ensuring the Acceptability of a New Fiat Money," *Journal of Money, Credit and Banking* 26, No. 4 (November 1994), pp. 808-26.
- Shaw, Edward, *Financial Deepening in Economic Development*, (New York: Oxford University Press, 1973).
- Shubik, Martin, "Fiat Money," in *The New Palgrave Dictionary of Economics*, v.2, (New York: The Stockton Press, 1987), pp. 316-317.
- Smith, P., "Assessing the Size of the Underground Economy: the Statistics Canada Perspective," *Canadian Economic Observer*, Statistics Canada Catalogue 11-010, 3, (1994), pp. 3.16-3.33.
- Schneider, Friedrich, "Can the Shadow Economy Be Reduced Through Major Tax Reforms? An Empirical Investigation for Austria," in Werner W. Pommerehne (ed.), *Public Finance and Irregular Activities*, supplement to *Public Finance* 49, 1994, pp. 137-52.

Figure 1
Effects of tax rates and inflation on velocity and the multiplier

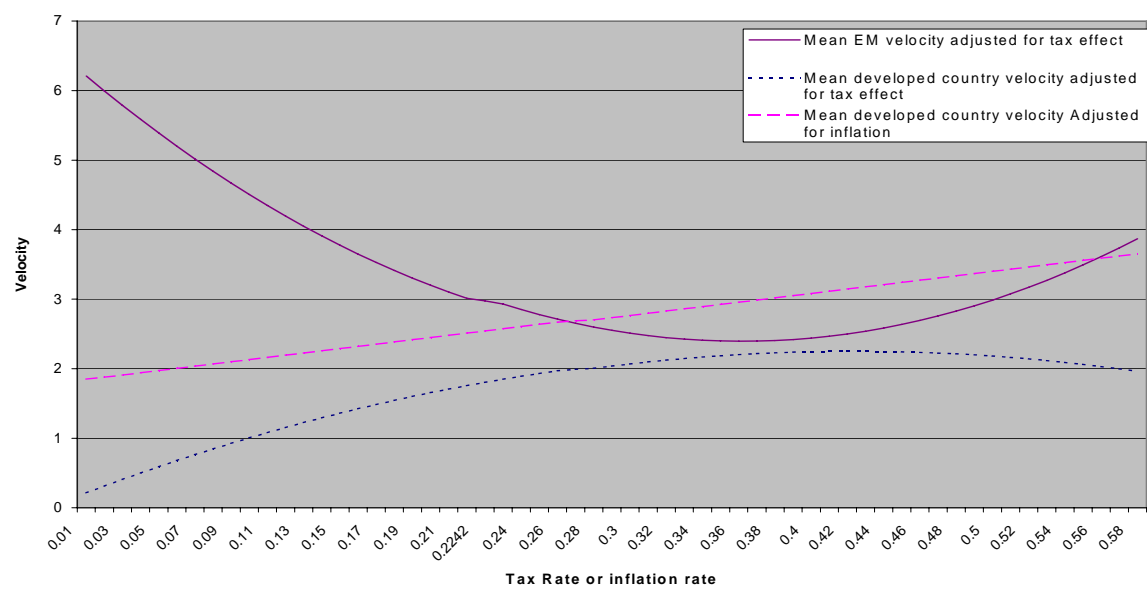


Table 1

Data Characteristics: Developed countries have higher money multipliers, lower velocity, higher taxes and lower inflation

(sample period:1970-2000)

	Money Multiplier	Velocity	Tax Rate	Inflation	Per Capita Real GDP*
Developed Countries					
Mean	8.8625	1.9917	0.2761	5.6033	9.39(\$11979)
Standard deviation	4.9971	0.8416	0.1027	4.4326	0.2656
Observations	507	504	475	527	503
Emerging Economies					
Mean	3.6385	2.9770	0.2242	62.5506	8.05 (\$2996)
Standard deviation	2.7531	1.5608	0.0972	356.5286	0.5779
Observations	794	731	686	825	892
Ratio of Developed to Emerging	2.43	0.67	1.23	0.090	1.386**

*Log level using 1996 international prices; ** difference

Table 2A
Emerging Markets Correlation Coefficients, 1970-2000**

	Money Multiplier	Velocity	Tax Rate	Inflation	Per Capita Real GDP*
Money Multiplier	----	-0.305 (8.64)	-0.021 (0.55)	-0.055 (1.52)	0.234 (6.59)
Velocity		---	-0.425 (11.97)	0.124 (3.31)	-0.196 (5.25)
Tax Rate			---	-0.057 (1.47)	0.297 (8.00)
Inflation				---	0.041 (1.14)
Per Capita Real GDP					---

*log level

** Bold: statistically significant; t-statistics in parentheses

Table 2B
Developed Countries Correlation Coefficients,1970-2000**

	Money Multiplier	Velocity	Tax Rate	Inflation	Per Capita Real GDP*
Money Multiplier	----	-0.218 (5.00)	-0.018 (0.39)	-0.218 (5.02)	0.274 (2.72)
Velocity		---	0.382 (8.92)	0.245 (5.66)	-0.212 (4.79)
Tax Rate			---	-0.103 (2.25)	0.121 (2.62)
Inflation				---	-0.411 (10.05)
Per Capita Real GDP					---

*log level

**Bold: statistically significant; t-statistics in parentheses.

Table 3
Velocity Regression Estimates, 1970-2000**

	Developed Countries		With Country effects	Emerging Economies		With Country effects
Constant	2.6591 (1.64)	0.3799 (1.56)	5.1357 (2.53)	6.8102 (9.07)	6.3992 (21.86)	14.9019 (8.50)
Inflation	0.0306 (3.37)	0.0317 (3.53)	---	0.0003 (2.41)	0.0003 (2.37)	---
Tax Rate	9.5818 (5.14)	10.0575 (5.54)	20.4112 (7.86)	-24.3059 (-10.13)	-22.3130 (-9.39)	-3.1070 (-3.00)
(Tax Rate)²	-11.0184 (-3.19)	-11.8814 (-3.52)	-30.5079 (-7.46)	33.1296 (7.66)	30.8613 (7.16)	---
Per Capita Real GDP*	-0.2426 (-1.42)	---	-0.6219 (-2.83)	-0.0077 (-0.07)	---	-1.1668 (-5.65)
Trend	-0.0171 (-2.83)	-0.0212 (-4.28)	-0.0171 (-3.08)	-0.0273 (-3.93)	-0.0203 (-3.15)	-0.0322 (-5.12)
Adjusted-R²	0.273	0.273	0.752	0.284	0.227	0.670
Standard error	0.7343	0.7294	0.4292	1.3371	1.3697	0.8934
Switching- Tax Rate	43.5%	42.3%	33.5%	36.7%	36.4%	NA

* log level

**t-statistics in parentheses

Table 4
Money Multiplier Regression Estimates, 1970-2000**

	Developed Countries	With country effects	Emerging Economies	With country effects
Constant	9.6431 (1.00)	-0.8838 (-0.36)	-5.9315 (-4.80)	-15.1959 (-7.30)
Inflation	0.0654 (1.20)	-0.1377 (-3.02)	-0.0004 (-1.58)	---
Tax Rate	11.8449 (1.49)	67.2623 (3.7827)	17.7033 (4.40)	9.7001 (2.74)
(Tax Rate)²	-35.5954 (-1.72)	-115.5940 (-4.03)	-37.3591 (-5.14)	-16.1596 (-2.56)
Per Capita Real GDP*	-0.6797 (-0.66)	---	0.9163 (5.63)	1.8650 (7.73)
Trend	0.3510 (9.70)	0.2413 (9.40)	0.0430 (3.76)	0.0427 (5.57)
Adjusted-R²	0.247	0.598	0.138	0.809
Standard error	4.4050	3.1868	2.2623	1.0515
Switching- Tax Rate	23.1%	29.1%	23.7%	30.0%

* log per capita income

**t-statistics in parentheses